E.2.6 SAVANNAH RIVER SITE

The process of manufacturing useful nuclear materials has produced radioactive, mixed, and hazardous wastes that are treated, stored, or disposed of at the SRS. The *Savannah River Site Waste Management Final Environmental Impact Statement* (DOE/EIS-0217) addresses the tasks to be completed in the next 10 years to clean up existing waste units and bring current operations into compliance with applicable regulations. It deals in detail with the current conditions and provides the preferred alternatives for processing current and future waste streams. It also addresses the development and funding of processes to minimize waste generation and to safely process and dispose of future waste generation.

Pollution Prevention. Pollution prevention, previously driven by best management practices and economics, is now mandated by statutes, regulations, and agency directives. The SRS Waste Minimization and Pollution Prevention Program is designed to achieve continuous reduction of wastes and pollutant releases to the maximum extent feasible and in accord with regulatory requirements while fulfilling national security missions. The *SRS Waste Minimization and Pollution Prevention Awareness Plan* addresses wastes and potential pollutants of all types and establishes priorities for accomplishing waste minimization and pollution prevention through source reduction, recycling, treatment, and environmentally safe disposal.

Spent Nuclear Fuel. [Text deleted.] DOE will make detailed decisions for SRS concerning the treatment and stabilization of its current and future inventory of spent nuclear fuel after the completion of site-specific analysis pursuant to NEPA. SRS has been one of the receiving sites for returned domestic and foreign research reactor spent fuel, and will manage all of DOE's aluminum-clad spent fuel. The stabilization and storage of spent nuclear fuel at SRS has been addressed programmatically in the ROD (60 FR 28680), as amended (61 FR 9441), for the *Department of Energy Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (Spent Nuclear Fuel EIS) (DOE/EIS-0203-F) and the ROD (61 FR 25092) for the *Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel* (DOE/EIS-0218F). There are about 206 t (227 tons) of spent reactor fuel in storage at SRS (60 FR 28680). As a result of the ROD from the programmatic Spent Nuclear Fuel EIS, SRS will increase its inventory of aluminum-clad spent nuclear fuel to 213 t (234 tons). As a result of the *Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel*, SRS will receive an additional 18.2 t (20.1 tons) of research reactor spent fuel and 0.6 t (0.7 tons) of target material.

High-Level Waste. Liquid HLW containing actinides and hazardous chemicals were generated from recovery and purification of TRU products and from spent fuel processing. These wastes were retreivably stored in 51 underground tanks. One of these tanks is out of service. The tanks are managed in compliance with Federal laws, State of South Carolina regulations, and DOE Orders. The waste is segregated by heat generation rate, neutralized to excess alkalinity, and stored to permit the decay of short-lived radionuclides before its volume is reduced by evaporation. Twenty-nine of the tanks are located in the H-Area Tank Farm, and 22 are located in the F-Area Tank Farm. The tanks are of four different designs, but all are of carbon steel. Wastes are transferred to and processed in the newer tanks, which have full-height secondary containment and forced-water cooling. Some older tanks contain old salt and sludge awaiting waste removal. Other old tanks have had waste removed, except for residue, and are used to store low-activity waste. The older tanks will be taken out of service when the contents of other tanks are transferred to the Defense Waste Processing Facility (DWPF).

High-heat liquid waste is stored for 1 to 2 years to allow decay of radionuclides before being processed through evaporators. Low-heat waste is sent directly to the evaporator feed tanks. Each tank farm has one evaporator that is used to reduce water volume and concentrate the solids. A replacement higher-capacity evaporator is planned and may be used in conjunction with the current evaporators. Liquids can be reduced to 25 to 33 percent of original volume and stored as salts or sludges. Cesium removal columns can operate in conjunction with the

evaporators. The evaporators obtain decontamination factors of 10,000 to 100,000, and the cesium removal columns can obtain another 10 to 200 decontamination factors. Decontaminated liquids (overheads) are sent to the ETF for processing before being released to Upper Three Runs Creek. The concentrated salt solution is processed to remove radionuclides, and the decontaminated solution is sent to the DWPF Saltstone Facility for solidification and storage in the saltstone vaults.

The remaining sludges and salts contain the majority of the radionuclides, and are stored separately, awaiting vitrification. Prior to vitrification, salt is precipitated in the in-tank precipitation process. The precipitate and sludge is fed into the vitrification process in the DWPF. The waste is mixed with borosilicate glass and immobilized by melting the mixture, then pouring it into stainless steel cylinders. These cylinders are stored in a shielded facility at the DWPF until a repository is available. Figure E.2.6–1 illustrates HLW management at SRS. Tables E.2.6–1, E.2.6–2, and E.2.6–3 list HLW inventories, treatment, and storage facilities at SRS.

Transuranic Waste. All TRU waste currently being generated is stored in containers on aboveground storage pads in compliance with state regulations and DOE Orders. Older TRU wastes (prior to 1965) were buried in plastic bags and cardboard boxes in earthen trenches. Wastes containing more than 0.1 Curies (Ci) per package were placed in concrete containers and buried. Wastes containing less than 0.1 Ci per package were buried unencapsulated in earthen trenches. Since 1974, TRU wastes containing more than 10 nCi/g have been stored in retrievable containers free of external contamination. Polyethylene-lined galvanized drums containing more than 0.5 Ci are additionally protected by closure in concrete culverts.

Approximately 85 percent of the TRU waste currently in storage is suspected of being contaminated with hazardous constituents. Presently, waste is characterized by onsite generators and is being stored prior to final disposal. TRU waste containing less than 100 nCi/g may be disposed of as LLW at SRS. Waste containing greater than 100 nCi/g, and meeting the final WIPP waste acceptance criteria, will be sent to WIPP, if WIPP is determined to be a suitable repository pursuant to the requirements of 40 CFR 191 and 40 CFR 268. Waste not meeting the acceptance criteria as currently packaged will be repackaged as necessary to meet the WIPP waste acceptance criteria. Should additional treatment be necessary for disposal at WIPP, SRS would develop the appropriate treatment technology, or ship this waste to another facility for treatment. Studies are under way to solve the problem of high-heat TRU waste, which is unique to SRS. Wastes with high Pu-238 fractions generate too much heat to be shipped in the TRUPACT-II. TRU waste is currently stored on 17 pads at the solid waste disposal facility in the E-Area. Figure E.2.6–2 illustrates the TRU waste management plan. Table E.2.6–4 lists the mixed TRU waste inventories, and Tables E.2.6–5 and E.2.6–6 list the TRU and mixed TRU waste treatment and storage facilities.

Low-Level Waste. Both liquid and solid LLW are treated at SRS. Liquids are managed and processed to remove and solidify the radioactive constituents and to release the balance of the liquids to permitted discharge points in compliance with state regulations. The bulk of liquid LLW is process wastewater consisting of effluent cooling water, purge water from storage basins for irradiated reactor fuel or target elements, distillate from the evaporation of process waste streams, and surface water runoff from areas where there is a potential for radioactive contamination.

Aqueous LLW streams are sent to the ETF and treated by filtration, reverse osmosis, and ion exchange to remove the radionuclide contaminants. After treatment, the effluent is discharged to Upper Three Runs Creek. The resultant wastes are concentrated by evaporation and stored in the H-Area tank farm for eventual treatment in the DWPF Saltstone Facility. In that facility, they will be processed with grout for onsite disposal. Figure E.2.6–3 illustrates the LLW processing at SRS. Treatment and storage facilities for LLW are listed in Tables E.2.6–7 and E.2.6–8.

Disposal of solid LLW at the SRS traditionally has been accomplished using engineered trenches in accordance with the guidelines and technology existing at the time of disposal. Currently, packaged LLW is deposited in the E-area vaults. These are concrete structures that meet the requirements of DOE Orders, incorporate

technological advances, and address more stringent Federal regulation and heightened environmental awareness. Four basic types of vaults/buildings are used for the different waste categories: low-activity waste vault, intermediate-level nontritium vault, intermediate-level tritium vault, and long-lived waste storage building.

The vaults are below-grade concrete structures and the storage building is a metal building on a concrete pad. Long-lived waste is being stored until a final disposition can be determined. Additional information on these facilities is given in Table E.2.6–9.

Solid LLW is segregated into several categories to facilitate proper treatment, storage, and disposal. Solid LLW that radiates less than 200 thousandths of one roentgen equivalent man (rem), also called 200 mrem, per hour at 5 cm from the unshielded container is considered low-activity waste. If it radiates greater than 200 mrem/hr at 5 cm, it is considered intermediate-activity waste. This waste is typically contaminated equipment from separations, reactors, or waste management facilities. Intermediate activity tritium waste is intermediate-activity waste with more than 10 Ci of tritium per container. Residuals from tritium operations equipment are included in this waste. Long-lived waste is contaminated with long-lived isotopes that exceed the waste acceptance criteria for disposal. Resin contaminated with carbon-14 from reactor operations is an example. Excavated soil from radiological materials areas that is potentially contaminated, and cannot be economically demonstrated to be uncontaminated, is managed as suspect soil. Solid LLW typically consists of protective clothing, contaminated equipment, irradiated hardware, residuals from tritium extraction operations, and spent deionizer resins. All LLW is disposed of in the solid waste disposal facility in the E-Area between the F- and H-Areas. Wastes are compacted and packaged for burial. Monitoring wells are located near each disposed waste area to verify performance and to monitor groundwater in the vicinity of the vaults. As of December 1994, the total inventory of LLW disposed of at SRS was 676,400 m^3 (884,700 yd^3) (DOE 1995kk).

Mixed Low-Level Waste. Management of mixed wastes includes safe storage until treatment is available. Mixed LLW is stored in the A-, E-, M-, N-, and S- Areas in various tanks and buildings. These facilities include burial-ground solvent tanks, the M-Area Process Waste Interim Treatment/Storage Facility, the Savannah River Technology Center mixed waste storage tanks, and the organic waste storage tanks. These South Carolina Department of Health and Environmental Control-permitted facilities will remain in use until appropriate treatment and disposal is performed on the waste.

The Hazardous/Mixed Waste Treatment and Disposal Facility and the Consolidated Incineration Facility will process both mixed and hazardous wastes. The mixed waste management plan for SRS, illustrated in Figure E.2.6–4, has been reevaluated through the development of a site treatment plan in accordance with the *Federal Facility Compliance Act*. Mixed waste inventories are listed in Table E.2.6–10. Treatment facilities and processes are listed in Table E.2.6–7. Storage facilities capacity and status are listed in Table E.2.6–8.

Hazardous Waste. Typical hazardous wastes at SRS are lead, mercury, cadmium, 1,1,1-trichloroethane, leaded oil, trichlorotrifluoroethane, benzene, and paint solvents. Figure E.2.6–5 illustrates hazardous wastes management at SRS. Table E.2.6–11 lists hazardous waste storage facilities at SRS.

This waste is stored in RCRA-permitted buildings in the B- and N-Areas. Although hazardous waste was previously sent offsite for treatment and disposal, DOE imposed a moratorium on shipments of hazardous materials from radiological areas. Now, waste that is confirmed as not subject to the moratorium is shipped to an offsite vendor for processing and disposal. SRS annually publishes the tier two emergency and hazardous chemical inventory report, which lists hazardous chemicals that are present above their minimum threshold level or are extremely hazardous substances under the emergency planning community *Right-to-Know Act of 1986*. The annual reports filed under the *Superfund Amendments and Reauthorization Act for the SRS* facilities include year-to-year inventories of these chemicals.

Nonhazardous Waste. SRS-generated municipal solid waste is currently being sent to a permitted offsite disposal facility. DOE is evaluating a proposal to participate in an interagency effort to establish a regional solid waste management center at SRS (DOE/EA-0989, DOE/EA-1079). SRS disposes of other nonhazardous wastes consisting of scrap metal, powerhouse ash, domestic sewage, scrap wood, construction debris, and used railroad ties, in a variety of ways.

Scrap metal is sold to salvage vendors for reclamation. Powerhouse ash and domestic sewage sludge is used for land reclamation. Scrap wood is burned onsite or chipped for mulch. Construction debris is used for erosion control. Railroad ties are shipped offsite for disposal. Nonhazardous waste management is illustrated in Figure E.2.6–6.